Actuation and sensing properties of Electroactive polymer whiskers

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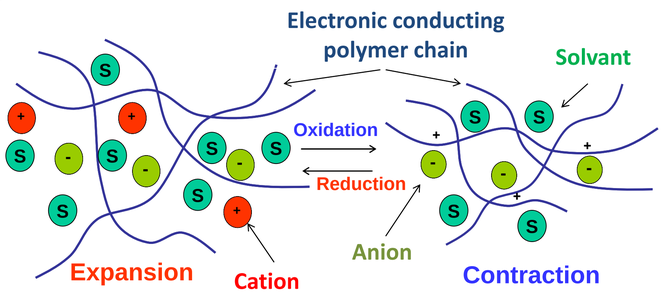
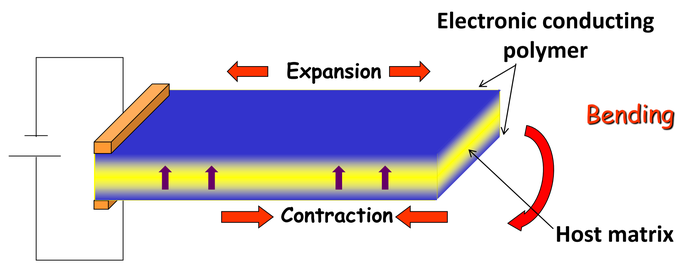
Background

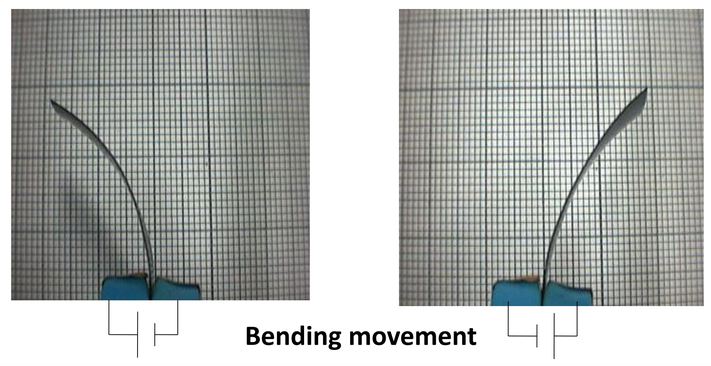


Redox process=volume change

Conducting interpenetrated polymer networks actuator



conducting IPN actuator



Bending movement

Aim

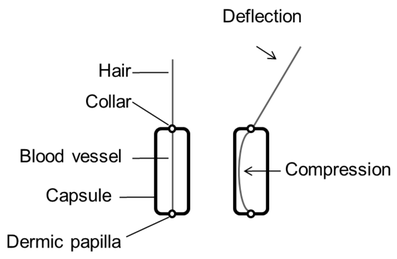
Integration of a conducting IPN actuator/sensor as artificial whisker

Advantages:
1. Open-air actuation
2. Low tension
3. Light weight
4. No delamination

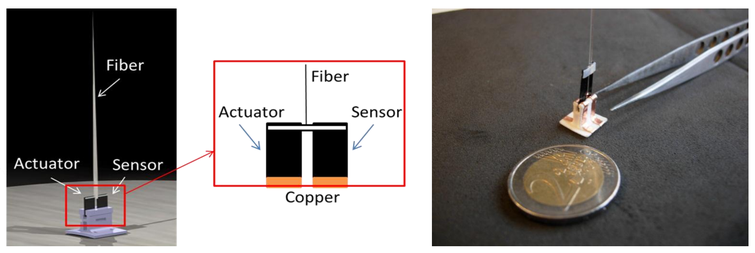
Drawbacks:

- **Improved conducting IPN actuator/sensor mechanical properties**
- **Improved conducting IPN actuator position control**
- **Improved conducting IPN sensor electrical response**

Design of a biomimetic artificial whisker



Whisker model
Mitchinson et al.,2004

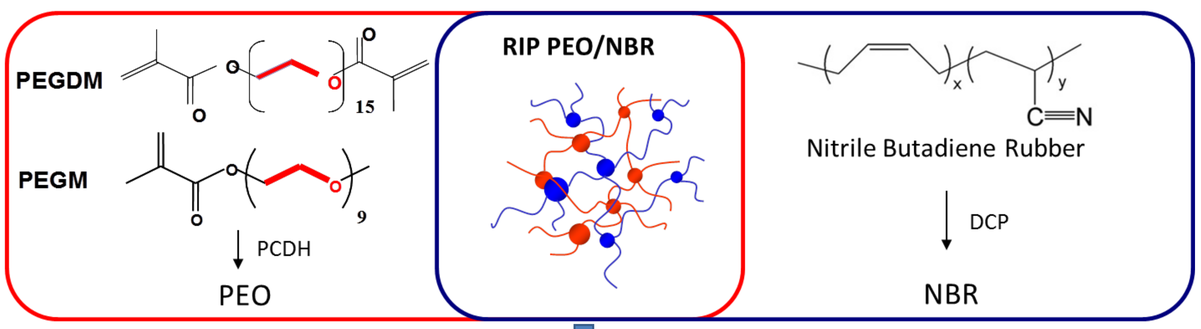


Biomimetic electroactive polymer whisker

Conducting IPN actuator/sensor

Actuator/sensor synthesis

Improved mechanical resistance and ionic conductivity of the host matrix



- ❑ High ionic conductivity
- ❑ Low mechanical properties

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- ❑ Low ionic conductivity

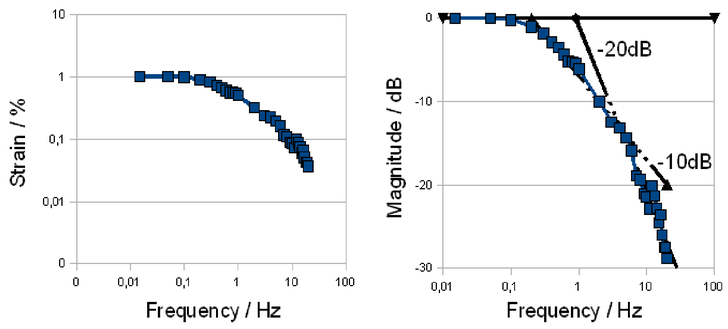
High ionic conducitvity
High mechanical properties

New conducting IPN actuator/sensor:

Strain: 1%
Force : 30 mN

Advantages:
1. Low price technology
2. Low tension
3. Light weight
4. Noiseless
5. Mechanical properties

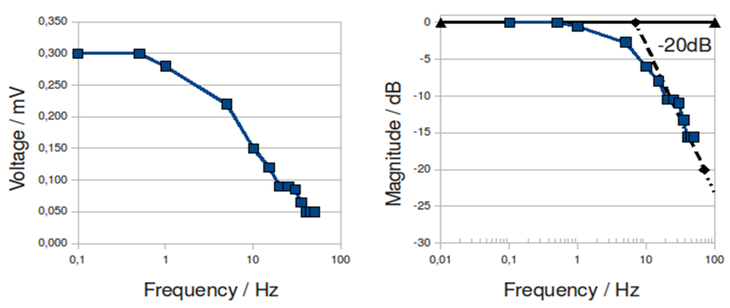
Actuator/sensor characterization



Strain of an actuator under ±2V

Maximum strain of 1%

Actuator frequency range: 0.1 to 1Hz



Voltage sensing response of a sensor under a strain of 2%

Maximum voltage output of 0,3mV

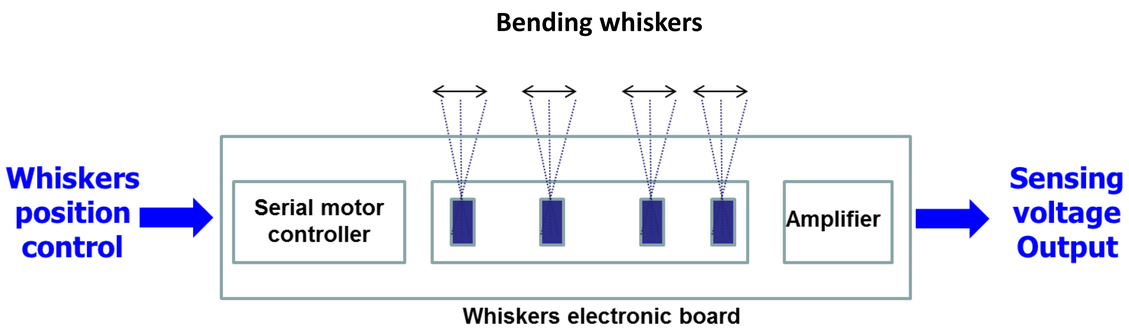
Sensor frequency range: 0.1 to 10Hz

Advantages: Light weight , noiseless and cheap technology

Drawbacks: Improved actuator and sensor frequency range

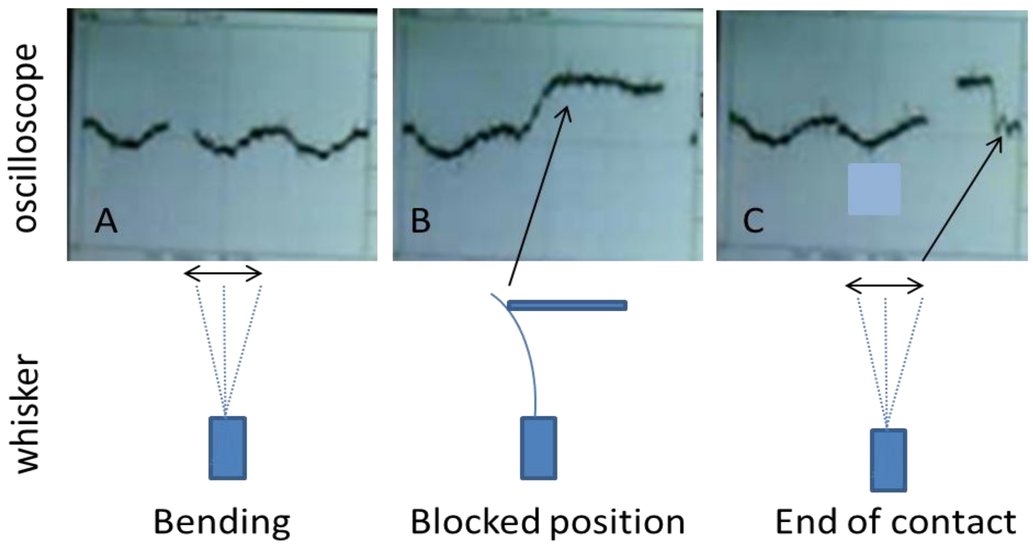
First prototype

Electroactive polymer whisker system



First autonomous system on electronic board with electroactive polymer whisker

Sensing voltage output



Publication

1)F. Vidal, C. Plesse, D. Teyssié, C. Chevrot, Synthetic Metals, 142 (2004) 287-291
2)F. Vidal, C. Plesse, G. Palaprat, A. Kheddar, J. Citerin, D. Teyssié, C. Chevrot Synthetic Metals, 156, 21-24 (2006), 1299-1304
3)C.Plesse, A.Khaldi, N.Festin,P.Pirim,E.Cattan,D.Teyssie,C.Chevrot, F.Vidal, Actuator 2010,Pages 444-447

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